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## WEATHER IN THE UNITED STATES

## THE WEATHER ELEMENTS

By P. C. DAY

## GENERAL SUMMARY

The important features of the weather of the month were the high temperatures experienced during the first few days over the greater part of the country from the Rocky Mountains eastward, the severe drought that existed at the end over the far Northwest, and the important tropical storm that threatened the coast districts of southern Florida during the last few days, which fortunately passed around the southern end of the peninsula and across the western part of the mainland and into Georgia and to the northeastward during the first few days of October. No important loss of life occurred during the passage of this storm and the damage to property from wind was mainly small, though considerable damage to crops and property was sustained on account of heavy rains and floods in some of the districts within the area of its influence.

## PRESSURE AND WINDS

The first indication of a break in the severe drought that had prevailed during much of the latter part of the summer over the greater part of the country appeared on the morning of September 3, when a cyclonic storm of moderate proportions was central over the Dakotas, attended by general, but only moderate precipitation over much of the Rocky Mountain area and into the northern Plains States. At the same time, local, heavy rains had occurred along the Gulf and South Atlantic coasts. During the 4th the storm area in the Northwest had extended eastward into the central Plains and to near the upper Mississippi Valley and northward into the adjacent Canadian Provinces with some increase in the rate of precipitation, and rains continued in the Gulf and South Atlantic coast regions, the falls becoming heavy locally in western Florida and the rains extending into the southern Appalachian region, though here they were mainly light.

By the morning of the 5th the northwestern disturbance had largely moved into the adjacent Canadian Provinces, but rains still continued over a considerable area from the northern portions of Texas and Louisiana northeastward to the upper Lakes, the falls being fairly generous in many portions of this area. At the same time, precipitation continued along the South Atlantic coast and had extended northward to the Chesapeake Bay region, with local, heavy falls near the coast from Florida to North Carolina. By the following morning the cyclonic conditions, existing during the preceding few days, had largely dissipated though local, heavy rains still persisted over portions of the middle Atlantic coast, in the lower Ohio and middle Mississippi Valleys and portions of the Lake region, and at scattered points in the Great Plains and portions of the Rocky Mountains where rain had changed to snow.

At the morning observation of the 7th anticyclonic conditions existed over the central valleys, but precipitation had persisted in widely scattered areas, frequent light thunderstorms occurring in the Southeastern States and extending into the Ohio Valley and portions of the lower Lake region, these conditions continuing over many eastern districts during the following day, with the precipitation area becoming better defined in the southern portions of the Plains and Rocky Mountain regions.

By the morning of the 9th a well-defined cyclone had developed over Iowa and heavy rains had fallen over near-by areas, effectually ending the drought over many localities which had been only partially relieved by the showers during the earlier part of the month. The cyclone had extended to the northward of Lake Superior by the morning of the 10th and further rains occurred over many districts from the upper Mississippi Valley to the Lake region, extending eastward to the New England coast, while scattered rains were reported from the Ohio Valley and portions of the Gulf States. Some heavy local rains were reported the following morning from points in Texas and the lower Mississippi Valley and showers continued near the Appalachian Mountains from northern Alabama to New England, but in most western districts fair weather had prevailed for several days.

At the 8 a. m. observation of the 13th a cyclonic storm that had advanced southeastward from central-western Canada without important precipitation became more active, and rain had occurred during the preceding 24 hours over an extensive area from the eastern Plains to the Great Lakes and southward over the Ohio and Mississippi Valleys to near the Gulf coast, heavy rains occurring in portions of Louisiana, the western parts of Tennessee and Kentucky, and in near-by areas. By the following day the rain area had extended eastward to the Atlantic coast, heavy falls occurring at numerous points in the more eastern districts. On the following day, precipitation occurred over the districts near the Atlantic coast, but elsewhere the weather very generally cleared and but little precipitation occurred during the following two days except rain was rather general, but mainly light, on the 17th over many eastern districts except near the Atlantic coast, and on the following day along the immediate Atlantic coast.

From the 19th to the 24th there was little precipitation in any part of the country, but on the latter date considerable rain occurred in the far Northwest and also in the Southeast. By the following morning the weather had largely cleared over the Northwest, but rain continued over the Southeast where there were signs of a tropical disturbance in the vicinity of the Bahama Islands, which, during the following few days, advanced slowly to the southwestward, reaching the vicinity of the southern end of the Florida Peninsula by the morning of the 28th. During the following 24 hours it passed between Key West and the mainland moving northwesterly toward Pensacola. It reached the vicinity of the latter place by the morning of the 30th where it changed its course to the northeast, passing the vicinity of Thomasville, Ga., by the morning of October 1 and thence continuing its course northeastward near the coast during the next few days. This storm was attended by the usual hurricane winds and heavy rains near its center, and unusually heavy rains occurred in portions of Florida, Georgia, and the Carolinas and to a lesser extent along the coast in more northern districts.

Anticyclones dominated, to some extent, the more northern districts, particularly the Northeastern States during the latter part of the second and much of the last decade, but no important changes in weather conditions resulted therefrom.

The winds of the month were not severe over any extensive area, though during the passage of the hurricane over some of the coast districts of Florida and to the

northeastward high winds were recorded, but on account of the precautionary measures adopted only a few lives were lost and no extensive damage to property resulted. A few tornadoes occurred, but only one life was lost thereby, though 25 persons lost their lives by the sinking of a boat in a gale on Lake Michigan.

The average atmospheric pressure was moderately higher than normal over all northern districts and to a considerable extent over the southeastern districts. Over the Gulf States and from Texas northwestward to central Washington and thence west to the Pacific averages of pressure were slightly less than normal. Compared with the preceding August, pressures were higher over all northern and most central districts, but were lower to the southward.

#### TEMPERATURE

The month was marked by much cool weather in the central and north-central portions, especially over the northern and middle divisions of the Plains and Rocky Mountain regions. A period of widespread heat during the first week was another noteworthy feature.

The opening of the month found high temperatures prevailing in the Eastern and Central States north of the Cotton Region. In the Northeast, with the lower Lake region and most of the Ohio Valley, the weather continued mainly hot during the first decade, though after the 4th temperatures usually were not so high as before. In Minnesota and all but the southernmost portions of the Plains and the Mountain regions the middle and later portions of this decade were unseasonably cool. The transition from heat to cold was an abrupt one over the Dakotas and adjacent districts, Bismarck recording 102° on the 1st and 32° on the 6th.

From the 10th to the 17th warmth prevailed in the far West, also mainly in the Atlantic and Gulf States, but most districts between the Rocky Mountains and the Appalachians were considerably cooler than normal.

About the 17th marked heat prevailed over large portions of California and Nevada, with a strong east wind bringing temperatures in the nineties about the hour of sunrise to some southern coast cities of California, where normally even the afternoon marks of September are in the seventies or low in the eighties. This strong east wind was probably due to the effect of a well-defined hurricane passing up the coast from the vicinity of lower California.

From the 17th to the 24th cool weather prevailed nearly everywhere east of the Rocky Mountains and in the far Northwest besides. Particularly cool weather for the season prevailed in the Lake region and the Northeast.

The closing week was notably cool in the far Northwest, but from Arizona and Utah eastward and north-eastward it was practically everywhere warmer than normal.

The month averaged cooler than normal over most of the central and western thirds of the country, also over a portion of the Southeast. In a record covering about 60 years at Cheyenne, Wyo., it was the coolest September, save one. Generally in Montana and the Dakotas, Nebraska, and eastern Wyoming the monthly temperatures averaged 4° to 6° below normal.

In the Pacific Northwest the month averaged warmer than normal, and generally from California to the middle Gulf region it was a trifle warmer than normal. In the Northeastern States there was a moderate excess, reaching 3° to 4° at points in interior New York.

The highest marks were usually recorded during the opening week, save in Idaho, Nevada, and the Pacific States about the middle of the month. The very highest was 117° in southern interior California on the 13th. East of the Rocky Mountains 110° was reported from Nebraska and South Dakota on the 1st and 2d.

Over the eastern half of the country the lowest marks were reached from the 17th to the 21st. The southern plains were coolest on the 10th, and several parts of the far West during the last few days of the month. The lowest of all reported readings was 12°, which occurred in four States on four different dates from the 7th to 27th.

The killing frosts in parts of Minnesota and the upper Lake region about the 18th were earlier than usual and ended a short growing season.

#### PRECIPITATION

There was decidedly heavy rainfall over most southeastern districts, while the northern plains and the Rocky Mountain area had nearly always considerable amounts for the season. For the country, as a whole, the month's precipitation was poorly distributed, both over the surface and in time of fall.

In Florida the average precipitation was larger than in any other State, being almost 11 inches. Fellsmere Station, in the central part of the State, measured 25.15 inches. In northern and eastern Georgia and the western portions of the Carolinas the totals were large, and generally the rainfall exceeded the normal as far west as central Louisiana and as far northwest as the lower and middle Ohio River. Part of eastern North Carolina had a marked excess, while in Virginia and to northeastward the distribution was uneven, the most notable region here of large falls extending from northeastern Maryland to southeastern New York. In the vicinity of New Orleans excessive precipitation occurred on the 6th and 7th, when 10.75 inches fell in less than 24 hours, the greatest amount ever recorded for that period of time in September.

From western Pennsylvania to central Illinois and in lower Michigan and eastern Wisconsin the rainfall was mainly deficient, frequently to the extent of 60 or 70 per cent.

West of the Mississippi River considerable deficiencies were reported from central and southeastern Texas, eastern Kansas, and the Pacific Northwest.

In California a peculiar situation was noted. The northern third of the State was practically without precipitation and the central portion had almost wholly small falls. In southern California, especially the interior portion, there were unusually large falls for the time of year, and large amounts fell farther eastward and northeastward to north-central New Mexico.

In the far Northwest the month was notably dry, Oregon reporting the least of September record in the climatological history of the State, and similar conditions existed in Washington, which had the least precipitation save in one year. The combined precipitation in both States for the three months, July to September, 1929, inclusive, was the least of record for those months.

#### SNOWFALL

Over most of Wyoming and considerable portions of adjoining States the snowfall was large for the time of year, notably about the 6th and 7th. However, few serious consequences came from this snow. In the high mountains of the Pacific and Plateau States a few light falls were noted.

## RELATIVE HUMIDITY

There were large excesses in the average percentages of relative humidity, as compared with the normal, in most of the mountain and southern plateau States, where

the positive departures ranged from 10 to 20 per cent; there were excesses also from the Ohio Valley southward and southeastward to the Gulf and South Atlantic States. In other districts the averages were mainly below normal, the deficiencies being large in the far Northwest.

## SEVERE LOCAL STORMS, SEPTEMBER, 1929

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the annual report of the chief of bureau]

Place	Date	Time	Width of path, yards <sup>1</sup>	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Fergus and Wheatland, Mont.	1					Hail	Considerable crop destruction	Official, U. S. Weather Bureau.
Toole and Hill, Mont.	2					do	do	Do.
Paducah, Tex.	4	3 p. m.	440		\$2,500	do	Crops damaged and poultry killed or injured	Do.
Rankin, Tex.	4	5.40 p. m.	4 mi.		4,000	Hail and wind	Buildings unroofed and otherwise damaged by wind.	Do.
Littlefield, Tex.	4	7 p. m.	10 mi.			do	Crops considerably injured	Do.
Liberty, Mont.	4					Hail	Crops damaged	Do.
Plainview, Tex.	5	8 p. m.	1,760		25,000	do	do	Do.
Spur, Tex.	5	8 p. m.	2,640		10,000	do	do	Do.
Crosbyton, Tex.	5	10 p. m.	3 mi.			do	Buildings and crops damaged	Do.
Anadarko, Okla.	8	5 p. m.	6 mi.		100,000	Wind and rain	Severe damage to property and crops	Do.
Kingston, Okla.	8	5 p. m.				Hail	Chief damage to crops; minor property damage	Do.
Fort Stockton, Tex.	8	5-7 p. m.	5 mi.		50,000	Wind	Much damage to property; 1 person injured	Do.
Chickasha, Okla. (4 miles southwest of)	8	7-8 p. m.	1,760		33,000	do	Damage chiefly to property other than crops	Do.
Chickasha, Okla. (northwest of)	8	8 p. m.	1,320			Hail	Crops and buildings damaged	Do.
Norman, Okla. (near)	8	9.15 p. m.	1,760		25,000	Wind	Airport and 2 planes damaged; 2 planes demolished; minor crop injury; 1 person injured	Do.
Stonewall, Okla. (near)	8	10 p. m.				Wind and hail	Crops badly damaged; 4 persons injured	Do.
Monroe, Wapello, and Delaware Counties, Iowa.	8	P. m.			63,000	do	Character of damage not reported	Do.
Pennsylvania (southeastern).	8			1	100,000	Wind, rain, and electrical.	Several barns destroyed; great crop damage over entire section.	Do.
San Jon, N. Mex. (10 miles southeast of)	8					Small tornado	A few farm buildings wrecked	Do.
Wayne, Okla., and vicinity.	8		2 mi.		75,000	Wind	Extensive damage to crops and other property	Do.
Westminster, Md.	8				20,000	Electrical	2 barns and contents destroyed	Do.
Spur, Tex.	9	10 p. m.	2 mi.		50,000	Hail	Crops damaged	Do.
Lake Michigan, (near Grand Haven, Mich.)	10			25		Wind	Steamer Andaste foundered, losing entire crew	Do.
Oilton, Tex.	11	8-9 p. m.	880		10,000	Hail	Crops considerably injured	Do.
Dillon, S. C.	14	2 p. m.	80		1,500	Small tornado	A warehouse damaged; 3 persons injured	Do.
Arizona (south-central and southeastern).	19-24				50,000	Wind, rain, and floods.	Much damage to roads, culverts, and bridges	Do.
Lee Ranch, N. Mex. (near)	25					Hail	75 per cent of crops ruined	Do.
Houghton, Mich.	27	P. m.				Thunderstorm, hail, and rain.	Windows broken; considerable damage to telephone and electric circuits.	Do.
Miami and Fort Lauderdale area, Fla.	28	P. m.				5 tornadoes.	Details not yet received	Do.
Florida (southern and western).	28-30			3	676,000	Tropical hurricane.	Heavy damage to fruit and truck, highways, telephone and telegraph lines, small boats and equipment, timber, buildings, power plants, and shops.	Do.
Grays Lake and Ava, Ill.	29					Electrical	4 barns destroyed	Do.
Pottsville, Pa., and vicinity.	29-30				20,000	Hail and rain	Damage confined to flooding of cellars, washing of fields, etc.; several small bridges destroyed.	Do.

<sup>1</sup> Mi. signifies miles instead of yards.

## RIVERS AND FLOODS

By R. E. SPENCER

No floods of importance occurred during September, except those in the South Atlantic and East Gulf States during the last three days and that in the Rio Grande in the vicinity of San Marcial, N. Mex., on the 23d. As the South Atlantic and East Gulf floods were in all cases merely forerunners of much more severe ones in early October, they will be discussed in the flood report for that month.

The Rio Grande rise, resulting from heavy local rains about the 22d, exceeded by 0.5 foot the high-water record of last month at San Marcial, destroying the levee and completely flooding the town. Press accounts state that only three buildings remained standing after the flood. Incomplete reports of losses place the total at \$92,000, divided as follows:

Tangible property	\$60,000
Matured crops	10,000
Prospective crops	15,000
Livestock, etc.	2,000
Suspension of business	5,000